CONTENTS

VOL. 42 FEBRUARY 2002 NO. 1

TAKING PHYSIOLOGY TO THE FIELD: ADVANCES IN INVESTIGATING PHYSIOLOGICAL FUNCTION IN FREE-LIVING VERTEBRATES

Organized by David L. Goldstein and Berry Pinshow

Taking physiology to the field: An introduction to the symposium DAVID L.GOLDSTEIN AND BERRY PINSHOW 1

Overcoming the constraints of long range radio telemetry from animals: Getting more useful data from smaller packages MIKE FEDAK, PHIL LOVELL, BERNIE MCCONNELL, AND COLIN HUNTER 3

Spring and autumn territoriality in song sparrows: Same behavior, different mechanisms? JOHN C. WINGFIELD AND KIRAN K. SOMA 11

The analysis of $^{13}C/^{12}C$ ratios in exhaled CO_2: Its advantages and potential application to field research to infer diet, changes in diet over time, and substrate metabolism in birds KENT A. HATCH, BERRY PINSHOW, AND JOHN R. SPEAKMAN 21

Assessing immunological function in toxicological studies of avian wildlife KEITH A. GRASMAN 34

Reproductive effort and reproductive nutrition of female desert tortoises: Essential field methods BRIAN THOMAS HENEN 43

Energetic bottlenecks and other design constraints in avian annual cycles THEUNIS PIERSMA 51

Ecological and evolutionary physiology of desert birds: A progress report JOSEPH B. WILLIAMS AND B. IRENE TIELEMAN 68

Physiological condition and reproductive consequences in Adélie penguins CAROL M. VLECK AND DAVID VLECK 76

STABILITY AND MANEUVERABILITY

Organized by Frank E. Fish and Robert J. Full

Balancing requirements for stability and maneuverability in cetaceans FRANK E. FISH 85

Control of posture, depth, and swimming trajectories of fishes PAUL W. WEBB 94

Maneuvering hydrodynamics of fish and small underwater vehicles PROMODE R. BANDYOPADHYAY 102

Maneuvering and stability performance of a robotic tuna JAMIE M. ANDERSON AND NARENDER K. CHHABRA 118

Stability versus maneuverability in aquatic locomotion DANIEL WEIHS 127

Mechanisms and implications of animal flight maneuverability ROBERT DUDLEY 135

Bird maneuvering flight: Blurred bodies, clear heads D. R. WARRICK, M. W. BUNDLE, AND K. P. DIAL 141

Quantifying dynamic stability and maneuverability in legged locomotion ROBERT J. FULL, TIMOTHY KUBOW, JOHN SCHMITT, PHILIP HOLMES, AND DANIEL KODITSCHEK 149

Stability and manoeuvrability of terrestrial vertebrates R. MCNEILL ALEXANDER 158

Stick insects walking along inclined surfaces BERND DIEDERICH, MICHAEL SCHUMM, AND HOLK CRUSE 165

Low impedance walking robots GILL ANDREWS PRATT 174

Book Review

Advances in Insect Physiology Volume 28 P. D. EVANS. (ED.) Reviewed by John S. Edwards 182

ERRATA 182

VOL. 42 APRIL 2002 NO. 2

MOLECULES, MUSCLES, AND MACROEVOLUTION: INTEGRATIVE FUNCTIONAL MORPHOLOGY

Organized by Miriam Ashley-Ross, Alice Gibb, and Lara Ferry-Graham

A brief history of vertebrate functional morphology MIRIAM A. ASHLEY-ROSS AND GARY B. GILLIS 183

A molecular mechanism for variations in muscle function in rainbow trout DAVID J. COUGHLIN 190

Functional morphology and biochemical indices of performance: Is there a correlation between metabolic enzyme activity and swimming performance? ALICE C. GIBB AND KATHRYN A. DICKSON 199

The intracardiac shunt as a source of myocardial oxygen in a turtle, *Trachemys scripta* C. G. FARMER AND J. W. HICKS 208

The functional morphology of penile erection: Tissue designs for increasing and maintaining stiffness D. A. KELLY 216

Functional morphology and developmental biology of zebrafish: Reciprocal illumination from an unlikely couple L. PATRICIA HERNÁNDEZ, MICHAEL J. F. BARRESI, AND STEPHEN H. DEVOTO 222

Functional morphology and virtual models: Physical constraints on the design of oscillating wings, fins, legs, and feet at intermediate Reynolds numbers JEFFREY A. WALKER 232

Experimental hydrodynamics of fish locomotion: Functional insights from wake visualization ELIOT G. DRUCKER AND GEORGE V. LAUDER 243

From odor molecules to plume tracking: An interdisciplinary, multilevel approach to olfaction in stomatopods KRISTINA S. MEAD 258

Using functional morphology to examine the ecology and evolution of specialization LARA A. FERRY-GRAHAM, DANIEL I. BOLNICK, AND PETER C. WAINWRIGHT 265

Evolutionary approaches for studying functional morphology: Examples from studies of per-formance capacity DUNCAN J. IRSCHICK 278

SYMBIOSIS: THE DYNAMICS OF LIVING TOGETHER

Organized by Mary Beth Saffo

Themes from variation: Probing the commonalities of symbiotic associations MARY BETH SAFFO 291

Investigation of four classes of non-nodulating white sweetclover (*Melilotus alba* annua Desr.) mutants and their responses to arbuscular-mycorrhizal fungi MICHELLE R. LUM, YING LI, THOMAS A. LARUE, RAKEFET DAVID-SCHWARTZ, YORAM KAPULNIK, AND ANN M. HIRSCH 295

The transmission of digenetic trematodes: Style, elegance, complexity GERALD W. ESCH, MICHAEL A. BARGER, AND K. JOEL FELLIS 304

Phylogenetic diversity and physiology of termite gut spirochetes JOHN A. BREZNAK 313

Mutualistic fermentative digestion in the gastrointestinal tract: Diversity and evolution RODERICK I. MACKIE 319

Comparative microbial diversity in the gastrointestinal tracts of food animal species JOYCE M. SIMPSON, SVETLANA A. KOCHERGINSKAYA, ROUSTAM I. AMINOV, LAURA T. SKERLOS, TERENCE M. BRADLEY, RODERICK I. MACKIE, AND BRYAN A. WHITE 327

Distribution of *Wolbachia* within *Drosophila* reproductive tissue: Implications for the expression of cyto-plasmic incompatibility MICHAEL E. CLARK AND TIMOTHY L. KARR 332

Effects of *Wolbachia* on genetic divergence between populations: Mainland-island model ARNDT TELSCHOW, PETER HAMMERSTEIN, AND JOHN H. WERREN 340

Host specificity in ectomycorrhizal communities: What do the exceptions tell us? THOMAS D. BRUNS, MARTIN I. BIDARTONDO, AND D. LEE TAYLOR 352

Fungal endophytes: Common host plant symbionts but uncommon mutualists STANLEY H. FAETH AND WILLIAM F. FAGAN 360

Partner choice in nitrogen-fixation mutualisms of legumes and rhizobia ELLEN L. SIMMS AND D. LEE TAYLOR 369

Coevolution and maladaptation JOHN N. THOMPSON, SCOTT L. NUISMER, AND RICHARD GOMULKIEWICZ 381

Molecular genetic perspectives on avian brood parasitism MICHAEL D. SORENSON AND ROBERT B. PAYNE 388

Coevolutionary genetics of *Plasmodium* malaria parasites and their human hosts ANDREW G. EVANS AND THOMAS E. WELLEMS 401

Book Review

World Atlas of Coral Reefs. MARK D. SPALDING, CORINNA RAVILIOUS, AND EDMUND P. GREEN. Reviewed by Alan J. Kohn 408

VOL. 42 JUNE 2002 NO. 3

PLANT/ANIMAL PHYSIOLOGY

Organized by Martin E. Feder

Plant and animal physiological ecology, comparative physiology/biochemistry, and evolutionary physiology: Opportunities for synergy: An introduction to the symposium MARTIN E. FEDER 409

Plants *versus* animals: Do they deal with stress in different ways? RAYMOND B. HUEY, MARGEN CARLSON, LIZA CROZIER, MELANIE FRAZIER, HAYDEN HAMILTON, CHRISTOPHER HARLEY, ANHTHU HOANG, AND JOEL G. KINGSOLVER 415

Atmospheric CO_2 as a global change driver influencing plant-animal interactions JAMES R. EHLERINGER, THURE E. CERLING, AND M. DENISE DEARING 424

Physiology on a landscape scale: Plant-animal interactions WARREN P. PORTER, JOHN L. SABO, CHRISTOPHER R. TRACY, O. J. REICHMAN, AND NAVIN Ramankutty 431

Shared signals and the potential for phylogenetic espionage between plants and animals JACK C. SCHULTZ 454

Sensing and responding to hypoxia: Molecular and physiological mechanisms PETER L. LUTZ AND HOWARD M. PRENTICE 463

How terrestrial organisms sense, signal, and respond to carbon dioxide ROWAN F. SAGE 469

Temporal dispersal: Ecological and evolutionary aspects of zooplankton egg banks and the role of sediment mixing NELSON G. HAIRSTON, JR. AND COLLEEN M. KEARNS 481

The dynamics of "dead wood": Maintenance of water transport through plant stems N. MICHELLE HOLBROOK, MACIEJ A. ZWIENIECKI, AND PETER J. MELCHER 492

Is there a single biochemical adaptation to anhydrobiosis? JOHN H. CROWE, ANN E. OLIVER, AND FERN TABLIN 497

STRESS—IS IT MORE THAN A DISEASE? A COMPARATIVE LOOK AT STRESS AND ADAPTATION

Organized by James A. Carr and Cliff H. Summers

Is stress more than a disease? A comparative look at the adaptiveness of stress JAMES A. CARR AND CLIFF H. SUMMERS 505

Causes and consequences of stress NEIL GREENBERG, JAMES A. CARR, AND CLIFF H. SUMMERS 508

Stress in fishes: A diversity of responses with particular reference to changes in circulating cor-ticosteroids BRUCE A. BARTON 517

Ethological aspects of stress in a model lizard, *Anolis carolinensis* NEIL GREENBERG 526

Neurocircuitry of stress integration: Anatomical pathways regulating the hypothalamo-pituitary-adrenocortical axis of the rat DANA R. ZIEGLER AND JAMES P. HERMAN 541

The role of corticotropin-releasing factor receptors in stress and anxiety TRACY L. BALE, KUO-FEN LEE, AND WYLIE W. VALE 552

A hassle a day may keep the doctor away: Stress and the augmentation of immune function FIRDAUS S. DHABHAR 556

Developmental changes in interrenal responsiveness in anuran amphibians KAREN A. GLENNEMEIER AND ROBERT J. DENVER 565

Cortisol and Pacific salmon: A new look at the role of stress hormones in olfaction and home-stream migration LAURA L. CARRUTH, RICHARD E. JONES, AND DAVID O. NORRIS 574

Stress, neuropeptides, and feeding behavior: A comparative perspective JAMES A. CARR 582

Social interaction over time: Implications for stress responsiveness CLIFF H. SUMMERS 591

Endocrine responses to unpredictable environmental events: Stress or anti-stress hormones? JOHN C. WINGFIELD AND ALEXANDER S. KITAYSKY 600

LESSER-KNOWN PROTOSTOME TAXA: EVOLUTION, DEVELOPMENT, AND ECOLOGY

Organized by James Garey

The lesser-known protostome taxa: An introduction and a tribute to Robert P. Higgins JAMES R. GAREY 611

Ultrastructure, biology, and phylogenetic relationships of Kinorhyncha BIRGER NEUHAUS AND ROBERT P. HIGGINS 619

Two dimensions of biodiversity research exemplified by Nematomorpha and Gastrotricha ANDREAS SCHMIDT-RHAESA 633

An introduction to Loricifera, Cycliophora, and Micrognathozoa REINHARDT MØBJERG KRISTENSEN 641

Current status of the Tardigrada: Evolution and ecology DIANE R. NELSON 652

Rotifers: Exquisite metazoans ROBERT LEE WALLACE 660

Acanthocephalan phylogeny and the evolution of parasitism THOMAS J. NEAR 668

Unsegmented annelids? Possible origins of four lophotrochozoan worm taxa KENNETH M. HALANYCH, THOMAS G. DAHLGREN, AND DAMHNAIT MCHUGH 678

The phylogenetic position of Entoprocta, Ectoprocta, Phoronida, and Brachiopoda CLAUS NIELSEN 685

Progress in nemertean biology: Development and Phylogeny J. M. TURBEVILLE 692

VOL. 42 SEPTEMBER 2002 NO. 4

RECENT EVENTS IN NEUROBIOLOGY

Organized by Richard Satterlie

Modulation of the crayfish escape reflex—Physiology and neuroethology FRANKLIN B. KRASNE AND DONALD H. EDWARDS 705

Decision-making in the leech nervous system TERESA ESCH AND WILLIAM B. KRISTAN, JR. 716

Behavioral, cellular, and molecular analysis of memory in *Aplysia* I: Intermediate-term memory MICHAEL A. SUTTON AND THOMAS J. CAREW 725

Behavioral, cellular, and molecular analysis of memory in *Aplysia* II: Long-term facilitation CAROLYN M. SHERFF AND THOMAS J. CAREW 736

Understanding vertebrate brain evolution R. GLENN NORTHCUTT 743

Grades in neural complexity: How large is the span? THEODORE HOLMES BULLOCK 757

How to build fast muscles: Synchronous and asynchronous designs DOUGLAS A. SYME AND ROBERT K. JOSEPHSON 762

PHYSIOLOGICAL ECOLOGY OF ROCKY INTERTIDAL ORGANISMS: FROM MOLECULESTO ECOSYSTEMS

Organized by Lars Tomanek and Brian Helmuth

Physiological ecology of rocky intertidal organisms: A synergy of concepts LARS TOMANEK AND BRIAN HELMUTH 771

The study of vertical zonation on rocky intertidal shores—A historical perspective KEITH R. BENSON .. 776

Thermal physiology and vertical zonation of intertidal animals: Optima, limits, and costs of living GEORGE N. SOMERO 780

Causes and consequences of thermal tolerance limits in rocky intertidal porcelain crabs, genus *Petrolisthes* JONATHON H. STILLMAN 790

The heat-shock response: Its variation, regulation and ecological importance in intertidal gas-tropods (genus *Tegula*) LARS TOMANEK 797

Molecular chaperones in ectothermic marine animals: Biochemical function and gene expression GRETCHEN E. HOFMANN, BRADLEY A. BUCKLEY, SEAN P. PLACE, AND MACKENZIE L. ZIPPAY 808

Patterns of variation in levels of Hsp70 in natural rocky shore populations from microscales tomesoscales PATRICIA M. HALPIN, CASCADE J. SORTE, GRETCHEN E. HOFMANN, AND BRUCE A. MENGE 815

Ecological genetics of Mpi and Gpi polymorphisms in the acorn barnacle and the spatial scale of neutral and non-neutral variation DAVID M. RAND, PAULA S. SPAETH, TIMOTHY B. SACKTON, AND PAUL S. SCHMIDT 825

How do we measure the environment? Linking intertidal thermal physiology and ecology through biophysics BRIAN HELMUTH 837

The ecomechanics of mussel attachment: From molecules to ecosystems EMILY CARRINGTON 846

Energetic constraints, size gradients, and size limits in benthic marine invertebrates KENNETH P. SEBENS 853

Physiological community ecology: Variation in metabolic activity of ecologically important rocky intertidal invertebrates along environmental gradients ELIZABETH P. DAHLHOFF, JONATHON H. STILLMAN, AND BRUCE A. MENGE 862

Biogeography, competition, and microclimate: The barnacle *Chthamalus fragilis* in New England DAVID S. WETHEY 872

Water temperature, predation, and the neglected role of physiological rate effects in rocky intertidal communities ERIC SANFORD 881

Environmental stress, bottom-up effects, and community dynamics: Integrating molecular-physiological and ecological approaches BRUCE A. MENGE, ANNETTE M. OLSON, AND ELIZABETH P. DAHLHOFF 892

Book Reviews

Denying Evolution. Creationism, Scientism and the Nature of Science MASSIMO PIGLIUCCI Reviewed by John S. Edwards 909

High Altitude: An Exploration of Human Adaptation T. F. HORNBEIN AND R. B. SCHOENE Reviewed by Raymond B. Huey 909

VOL. 42 NOVEMBER 2002 NO. 5

INTEGRATIVE APPROACHES TO BIOGEOGRAPHY: PATTERNS AND PROCESSES ON LAND AND SEA

Organized by Rachel Collin and Marta de Maintenon

Integrated approaches to biogeography: Patterns and processes on land and in the sea RACHEL COLLIN AND MARTA DE MAINTENON 911

Phylogeography of four frog species in forest fragments of Northeastern Brazil—A preliminary study ANA CAROLINA O. Q. CARNAVAL 913

Diversification in the tropical Pacific: Comparisons between marine and terrestrial systems and the importance of founder speciation GUSTAV PAULAY AND CHRIS MEYER 922

The geography of evolutionary opportunity: Hypothesis and two cases in gastropods GEERAT J. VERMEIJ 935

The marine Indo-Pacific break: Contrasting the resolving power of mitochondrial and nuclear genes S. T. WILLIAMS, J. JARA, E. GOMEZ, AND N. KNOWLTON 941

Methods in comparative phylogeography, and their application to studying evolution in the North American aridlands ROBERT M. ZINK 953

DYNAMICS AND ENERGETICS OF ANIMAL SWIMMING AND FLYING

Organized by Malcolm S. Gordon, Jay R. Hove, and Ian K. Bartol

Dynamics and energetics of animal swimming and flying: Introduction MALCOLM S. GORDON, JAY R. HOVE, AND IAN K. BARTOL 960

Quantitative flow visualization: Toward a comprehensive flow diagnostic tool MORY GHARIB, FRANCISCO PEREIRA, DANA DABIRI, JAY R. HOVE, AND DARIUS MODARRESS 964

Flow Patterns around the carapaces of rigid-bodied, multi-propulsor boxfishes (Teleostei: Ostraciidae) IAN K. BARTOL, MALCOLM S. GORDON, MORTEZA GHARIB, JAY R. HOVE, PAUL W. WEBB, AND DANIEL WEIHS 971

Riding the waves: The role of the body wave in undulatory fish swimming ULRIKE K. MÜLLER, EIZE J. STAMHUIS, AND JOHN J. VIDELER 981

The scaling and structure of aquatic animal wakes JOHN J. VIDELER, EIZE J. STAMHUIS, ULRIKE K. MÜLLER, AND LUCA A. VAN DUREN 988

Wake dynamics and locomotor function in fishes: Interpreting evolutionary patterns in pectoral fin design ELIOT G. DRUCKER AND GEORGE V. LAUDER 997

Experimental hydrodynamics and evolution: Function of median fins in ray-finned fishes GEORGE V. LAUDER, JENNIFER C. NAUEN, AND ELIOT G. DRUCKER 1009

Power requirements of swimming: Do new methods resolve old questions? WILLIAM W. SCHULTZ AND PAUL W. WEBB 1018

Vorticity control in fish-like propulsion and maneuvering M. S. TRIANTAFYLLOU, A. H. TECHET, Q. ZHU, D. N. BEAL, F. S. HOVER, AND D. K. P. YUE 1026

Kinematics, dynamics, and energetics of rowing and flapping propulsion in fishes JEFFREY A. WALKER AND MARK W. WESTNEAT 1032

Flexible wings and fins: Bending by inertial or fluid-dynamic forces? THOMAS L. DANIEL AND STACEY S. COMBES 1044

Computational biological fluid dynamics: Digitizing and visualizing animal swimming and flying HAO LIU 1050

The merits and implications of travel by swimming, flight and running for animals of different sizes R. MCNEILL ALEXANDER 1060

Telemetered cephalopod energetics: Swimming, soaring, and blimping RON O'DOR 1065

Dynamics of Dolphin porpoising revisited D. WEIHS 1071

Book Reviews

The Amphibians and Reptiles of Costa Rica: A Herpetofauna Between Two Continents, Between Two Sea JAY M. SAVAGE Reviewed by Raymond B. Huey 1079

Acoustic Communication in Insects and Anurans: Common Problems and Diverse Solutions H. CARL GERHARDT AND FRANZ HUBER Reviewed by Ann V. Hedrick 1079

VOL. 42 DECEMBER 2002 NO. 6

Biomechanics of Adhesion

Organized by Keller Autumn and Robert J. Full Supported by the Defense Advanced Research Projects Agency, Controlled Biological and Biomimetic Systems Program under the auspices of Dr. Alan Rudolph

Mechanisms of adhesion in geckos KELLAR AUTUMN AND ANNE M. PEATTIE 1081

Attachment to plant surface waxes by an insect predator SANFORD D. EIGENBRODE AND REINHARD JETTER 1091

An integrative study of insect adhesion: Mechanics and wet adhesion of pretarsal pads in ants WALTER FEDERLE, MATHIS RIEHLE, ADAM S. G. CURTIS, AND ROBERT J. FULL 1100

Biomechanics of adhesion in sea cucumber Cuvierian tubules (Echinodermata, Holothuroidea) PATRICK FLAMMING, JÉRÔME RIBESSE, AND MICHEL JANGOUX 1107

The influence of surface wettability on the adhesion strength of settled spores of the green alga Enteromorpha and the diatom Amphora JOHN A. FINLAY, MAUREEN E. CALLOW, LINNEA K. ISTA, GABRIEL P. LOPEZ, AND JAMES A. CALLOW 1116

Stickiness—Some Fundamentals of Adhesion CYPRIEN GAY 1123

Structural design and biomechanics of friction-based releasable attachment devices in insects STANISLAV N. GORB, ROLF G. BEUTEL, ELENA V. GORB, YUEKAN JIAO, VICTORIA KASTNER, SENTA NIEDEREGGER, VALENTIN L. POPOV, MATTHIAS SCHERGE, ULI SCHWARZ, AND WALTER VÖTSCH 1127

Mechanics of adhesion through a fibrillar microstructure ANAND JAGOTA AND STEPHEN J. BENNISON 1140

The structure and adhesive mechanism of octupus suckers WILLIAM M. KIER AND ANDREW M. SMITH 1146

Integrative functional morphology of the gekkotan adhesive system (Reptilia: Gekkota) ANTHONY P. RUSSELL 1154

The structure and function of adhesive gels from invertebrates ANDREW M. SMITH 1164

Adhesion à la Moule J. HERBERT WAITE 1172

Book Reviews

Analysis and Management of Animal Populations. Modeling Estimation, and Decision Making Byron K. Williams, James D. Nichols, and Michael J.Conroy

Quantitative Conservation Biology. Theory, Absracts and Practice of Population Viability Analysis WILLIAM F. MORRIS AND DANIEL F. DOAK Reviewed by Michelle A. Marvier 1181

ABSTRACTS 1183

VOLUME CONTENTS i